

WHAT IS CLAIMED IS:

1. An information processing method for calculating $x \cdot (2^n) \bmod P$ for an input value x larger than a prime number P , the operator \wedge denoting power, wherein:

the value $x \cdot (2^n) \bmod P$ is calculated without explicitly obtaining $x \bmod P$, by:

calculating or previously preparing $2^{(2m+n)} \bmod P$ when the input value x has to be transformed into $x \cdot (2^n) \bmod P$, the number n denoting the number of bits necessary and sufficient for storing the modulus P and the number m denoting the number of bits necessary for storing the input value x ;

calculating $x_1 = x \cdot 2^{(2m+n)} \cdot (2^{-m}) \bmod P = x \cdot 2^{(m+n)} \bmod P$ by Montgomery modular multiplication; and

calculating $x_2 := x_1 \cdot (2^{-m}) \bmod P = x \cdot (2^n) \bmod P$.

2. An information processing method for calculating $x \cdot (2^n) \bmod P$ for an input value x larger than a prime number P , the operator \wedge denoting power, wherein:

the value $x \cdot (2^n) \bmod P$ is calculated without explicitly obtaining $x \bmod P$, by:

calculating or previously preparing $2^{(m+2n)} \bmod P$ when the input value x has to be transformed into $x \cdot (2^n) \bmod P$, the number n denoting the number of bits necessary and sufficient for storing the modulus P and

the number m denoting the number of bits necessary for storing the input value x ;

calculating $x_1 = x \cdot 2^{(m+2n)} \cdot (2^{-m}) \bmod P = x \cdot 2^{(2n)} \bmod P$ by Montgomery modular multiplication;
and

calculating $x_2 := x_1 \cdot (2^{-n}) \bmod P = x \cdot (2^n) \bmod P$.

3. An information processing method for conducting a modular exponentiation operation $x^d \bmod P$ for an input value x and an exponent d , by combining results of exponentiation operations each of which is carried out for each s -bit segment successively extracted from the exponent d , wherein:

the value $x^d \bmod P$ is calculated not by calculating $x^{d[i]} \bmod P$, the exponent $d[i]$ denoting i -th segment of the extracted s -bit segment of the exponent d , but by:

calculating $(2^n)^{(2^n-1)} \cdot x^d \bmod P$ by use of $(2^n)^{(2^s-1)} \cdot x^{d[i]} \bmod P$, the number n denoting the number of bits necessary and sufficient for storing the modulus P and the number m denoting the number of bits necessary for storing the input value x ; and

calculating the value $x^d \bmod P$ by multiplying the above result $(2^n)^{(2^n-1)} \cdot x^d \bmod P$ by $2^{-n} \cdot (2^n)^{(2^n-1)} \bmod P$.